

What is claimed is:

1. An optical fiber comprising:
  - a central core having a relative refractive index delta  $\Delta_C$ ,
  - a multi-pedestal region in contact with and surrounding said core, said multi-pedestal region having an outer radius of less than 25  $\mu\text{m}$  and at least two pedestals, each of said pedestals being in contact with and adjacent to at least one other pedestal, each of said pedestals having a relative refractive index delta  $\Delta_{\text{ped}}$  lower than  $\Delta_C$ , at least one of said pedestals having  $\Delta_{\text{ped}}$  value higher than 0.2% and a width of less than 6  $\mu\text{m}$  and another one of said pedestals having  $\Delta_{\text{ped}}$  value lower than 0.2%; and
  - another region in contact and surrounding said multi-pedestal region, said another region having relative refractive index delta which is lower than that of any pedestal.
2. The optical fiber according to claim 1, wherein said another region is cladding, said cladding having an index of refraction  $n_{\text{Cl}}$  which is lower than that of any pedestal.
3. The optical fiber according to claim 2, wherein said multiple-pedestal region includes 5 or fewer pedestals with  $\Delta_{\text{ped}}$  values higher than 0.2% and the widths of the pedestals is 6  $\mu\text{m}$  or less.
4. The optical fiber according to claim 3, wherein the index of refraction and  $\Delta_{\text{ped}}$ , of each of said pedestals in said pedestal region, is lower than that of the preceding pedestal.
5. The optical fiber according to claim 3, wherein the widths of these pedestals is 0.2  $\mu\text{m}$  to 5  $\mu\text{m}$ .
6. The optical fiber according to claim 1, wherein said fiber has mode field diameter MFD between 6  $\mu\text{m}$  and 8  $\mu\text{m}$  at 1550nm and a cut-off wavelength  $\lambda \leq 980 \mu\text{m}$ .

7. The optical fiber according to claim 1, wherein at least one of said pedestals has  $\Delta_{\text{ped}}$  value higher than 0.3% and lower than 0.7%
8. An optical fiber comprising:
  - a central core having a relative refractive index delta  $\Delta_{\text{C}}$ ,
  - a multi-pedestal region surrounding said core, said multi-pedestal region having an outer radius of less than 25 $\mu\text{m}$ , said region having at least two pedestals, at least one of said pedestals having  $\Delta_{\text{ped}}$  value higher than 0.2% and lower than  $\Delta_{\text{C}}$  and a width less than 6  $\mu\text{m}$ ; and
  - another region in contact and surrounding said multi-pedestal region, said another region having a relative refractive index delta than that of any pedestal.
9. The optical fiber according to claim 8, wherein said multiple-pedestal region includes 6 or fewer pedestals with  $\Delta_{\text{ped}}$  values higher than 0.2% and the widths of each of these pedestals with  $\Delta_{\text{ped}}$  values higher than 0.2% is less than 5  $\mu\text{m}$ .
10. The optical fiber according to claim 8, wherein said multiple-pedestal region includes 5 or fewer pedestals with  $\Delta_{\text{ped}}$  values higher than 0.2% and the widths of each of these pedestals with  $\Delta_{\text{ped}}$  values higher than 0.2% is between 0.2  $\mu\text{m}$  and 4  $\mu\text{m}$ .
11. The optical fiber according to claim 8, wherein said multiple-pedestal region includes 6 or fewer pedestals with  $\Delta_{\text{ped}}$  values higher than 0.2% and the total width of these pedestals with  $\Delta_{\text{ped}}$  values higher than 0.2% is less than 15  $\mu\text{m}$ .
12. The optical fiber according to claim 8, wherein said fiber has mode field diameter MFD between 6  $\mu\text{m}$  and 8  $\mu\text{m}$  at a wavelength of 1550nm and a cut-off wavelength of no more than 980 nm.
13. The optical fiber according to claim 8, said optical fiber having a taper ratio between 1.5 and 3 and the difference  $\text{LP}_{01} - \text{LP}_{02}$ , measured at  $\lambda=1550\text{nm}$ , larger than 0.0019  $\mu\text{m}^{-1}$ .

14. The optical fiber according to claim 8, said optical fiber having a taper ratio between 1.5 and 3 and the difference  $LP_{01} - LP_{02}$  between  $0.0019 \mu\text{m}^{-1}$  and  $0.003 \mu\text{m}^{-1}$ .
15. The optical fiber according to claim 8, said optical fiber having (i) a taper ratio between 1.5 and 3; and (ii) non-adiabatic taper induced loss of less than 0.1 dB.
16. The optical fiber according to claim 8, said optical fiber having (i) a taper ratio between 1.5 and 3; and (ii) non-adiabatic taper induced loss of less than 0.06 dB.
17. The optical fiber of claim 8 wherein at least one of said pedestal corresponds to a region in said optical fiber that has Ge doping of 2 wt% to 17 wt%.
18. The optical fiber according to claim 8, said optical fiber having central core radius  $R_c \leq 5 \mu\text{m}$ .
19. The optical fiber according to claim 18, said optical fiber h having central core radius  $0.8 \mu\text{m} \leq R_c \leq 2.5 \mu\text{m}$ .
20. An optical coupler including at least one fiber of claim 1, said optical fiber having a taper ratio between 1.5 and 4, wherein taper ratio is the ratio between fiber diameter at a non-tapered region and fiber diameter at the narrowest, tapered region.
21. An optical coupler including at least one fiber of claim 18, said optical fiber having a taper ratio between 1.5 and 3.